satisfactory indications of their pedigree, their affinities with the Cypseli being perhaps the least far-fetched.

The *Makrochires* = Cypselidæ + Trochilidæ, prove to be far more closely related to the Passeres than to the Caprimulgi. The old group of the "Cypselomorphæ" had therefore to be broken up.

Pico-Passeres.—Very intimate relationship connects the Indicatoridæ, Capitonidæ, Rhamphastidæ, and the Picidæ to one group—*Pici.* Primitive Pici existed in the Eocene age; many threads bind them to the Galbulæ and to the Halcyones, still more to the Pseudoscines.

Passeres.—They represent the highest types which the avian stock has as yet developed. In spite of their enormous number of genera and species, which surpasses that of all the rest of the birds, they agree so closely with each other in all their principal and primary characters that the Passeres proper are morphologically only of the value of one family. This uniformity has naturally always rendered their further classification very difficult.

Fuerbringer divides them as follows, in close conformity with the views held by most English ornithologists.

I. Family *Pseudoscines* = Atrichia + Menura.—They are types which are now dying out, and which differ from all other Passeres through those characters which they have in common with the Pici.

II. Family *Passeridæ*, with four sub-families.

(1) Desmodactyli = Eurylæmidæ.—They differ fundamentally from the Coraciæ, and are the last remnants of the oldest Passerine forms.

(2) *Oligomyodi.*—Their wide distribution—*e.g.* Pitta in the Oriental and Ethiopian regions, Xenicus in New Zealand, the overwhelming majority in the Neotropical region—sufficiently indicates the extreme age of the Oligomyodi, and sufficiently accounts for the great diversity in the development of the syrinx, podotheca, and femoral artery, &c., which makes these birds appear a rather heterogeneous group.

(3) *Tracheophones.*—The tracheophonous syrinx, and the entirely Neotropical distribution of the Conopophaginæ, Pteroptochinæ, Formicariinæ, Furnariinæ, and Dendrocolaptinæ, suggest a monophyletic origin of these birds from lower American Oligomyodi.

(4) *Oscines* s. *Acromyodi.*—This family forms what may be called the topmost branches of the avian tree, with the Corvinæ as its culmination. It is characterized by the diacromyodean syrinx, and by the bilaminate covering of the tarsus. The latter feature occurs, however, also in the tracheophonous genus Heterocnemis, and is absent in the Alaudinæ.

Regarding the development of these four sub-families of the Passeridæ, the reader may be referred to a previous page (p. 178) of this summary.

Most probably all birds are the descendants of one reptilian form, though of which we do not know. The first lizard-like birds were small, and very likely terrestrial. They diverged into climbers on rocks and trees, and into inhabitants of swampy regions. The latter stock gave rise to swimming birds. The first birds were not vegetable feeders, as is generally supposed, but lived on insects and other small Invertebrata.

Lastly, there arises the question: What are the reasons for the natural extinction of large birds? Not predestination or catastrophes.

High differentiation, possible only through the one-sided development of certain organic systems and correlated regressive metamorphosis of the others, has, in the older groups of birds, frequently led to increased size of the body. This size, although securing a predominant position to the birds for the time being, inevitably implies the turning-point in the height of their development Large or highly specialized animals will be least able to adapt themselves to further changes of their never-stationary, ever-changing surroundings, because, through their very one-sidedness, the retrograded as well as the most specialized organs have rendered the whole organism more fixed than is the case with lower or less differentiated and therefore still plastic contemporaries. Amongst the younger groups of birds such a large size as is common amongst old and isolated types has not yet been reached, and probably will always be avoided. Small, but equally developed, will be the birds of the future.

So far so good. But with all this praise, are there no faults in Prof. Fuerbringer's work? Certainly, there are some. Its greatest fault may be indicated and at the same time explained in one sentence. If the author had been able to devote another year's labour to his "Epoche machenden Untersuchungen," he probably would have written a smaller book. H. GADOW.

MUSINGS ON A MEADOW.

TO the general observer nothing in the way of vegetation would appear to present so few aspects, so limited a scope to the imagination and the associative faculties, as an expanse of herbage; and yet, perhaps, nothing that bountiful Nature has provided for the use and service of men so teems with the variety of associations that it presents to each different mind.

The farmer, whether he be the farmer of England, the wandering Bedouin, or the ranch-man of the New World, looks at the broad pastures and far-stretching plains, but not to admire the mingled masses of gorgeous colours, not to speculate upon the battle that may have been fought upon this spot or the scenes that have happened there in former times, not to separate the numerous varieties of grasses into their many botanical genera and species, but to calculate how many sheep he can feed to the acre upon it, whether there is enough of white clover to fatten his camels upon, or whether his horses will have a sufficiency of suitable food to graze upon. The wide wild waste of endless lines of pale yellow, red, and gray, conveys no pleasure, but merely the indication of a good soil; and the buttercups and daisies he sees in the pasture meadows of England, hallowed by songs and memories, are to his economic eye positively offensive; knowing, as he does, that the older these buttercups grow, the more distasteful they become to stock, but never stopping to discover that it is because they become more acrid. To him it would seem a species of legerdemain if a botanist were to say to him, pointing to a buttercup, "Dig that up, and you will find a tuber at the root," and were then to select another, apparently similar in appearance to the former, and were to tell him that it had no tuber at the root; for from his eyes are completely hidden those minute differences so easily seen by the specialist between *Ranunculus bulbosus* and *Ranunculus acris.*

The botanist, on the other hand, as his eye rests on the same spreading plains of green, is utterly regardless of the feeding value of the plants that he sees before him. As he wanders from country to country, his eager eye detects the diminution or increase of particular species in different latitudes and altitudes, searching out the truths of Nature, or watching with a view to the confirmation of some pet theory. His mind ranges over the different prairies, plains, and meadows of the world. Again the battle of plant life is waging for him. His delight is unbounded. Every plant has its own history, so evident to him, so abstruse to the mere superficial observer; and, involuntarily, associations crowd upon his mind, of some musty tome perchance, or some ancient and not very accurate plate, or some amusing anecdote. For example, the cactus in the plains of Arizona or Texas reminds him of the many times he has seen this genus portrayed in pictures of the Holy Land at the time of the Founder of Christianity, and how, even in books pretending to be learned, he has met with it in the description of the plants of Syria of 2000 years ago, although, as a matter of sober history, this plant was only introduced into the Eastern Hemisphere after the discovery of America, in which continent the cactus is indigenous. Even if he be colour-blind, and the petals of the blazing poppy show to him the same tone as its sober sepals, yet he is still able to admire the beauty of form, which conveys to him the history of the development of the plant from its seed, and he would still be in the position to give a discourse interesting to the uninitiated though intelligent observer; and at the end of an hour's conversation, in common with others, he would be compelled to exclaim that there was still much in the life of the plant of which he was utterly ignorant—so limitless are the subtle workings of Nature!

But what does the artist care for either of these views? He cares not for the fattening of stock. He feasts with rapture on the different grays, greens, yellows, blues, and reds, that are spread out before him, and on the delicate tints and shadows cast by every passing cloud. He cares not to know of the buttercups and daisies that grow there; it would even distress him to tell him that the yellow-greens are groups of fescues, and the blue-greens patches of cock's-foot and fox-tail. What is that to him? He was wondering what colour in his box would reproduce those delicate tones. He does not seek to know how much corn to the acre that meadow would grow if ploughed up, nor how much it might once have grown. To him it is merely one endless feast of colour.

Perchance more sordid ideas of another kind may occur to him. Apprehensions as to the hanging of his picture may dispel his rapture in Nature's handiwork, and his mind may be occupied with a fear lest the red ground of his neighbour's picture will kill his own more delicate tones. Pounds, shillings, and pence, the cares of a wife and family, are apt to destroy for a time the beauties of Nature.

How happy is the man who sketches and sketches only to reproduce for himself these works of Nature; whether they be the meadows of England, dotted with short-horns and Hampshire Downs, and bounded by the rook-sheltering elm; or the plain of Megiddo; or the boundless prairie of Manitoba.

How differently again would the antiquary survey the self-same scene! His mind would revert to the people who trod these plains in days of yore. Their history, manners, customs, dress, and social habits, would open out to him a wide field of speculation. On this very pasture contending armies may once have trod, and the ebbing life-blood of patriotic heroes once have flowed. His eyes may be resting on a Bannockburn, or a Worcester, or a spot where the Carthaginians of old strove against the might of Rome, and were worsted in the fight. Here the chariots of the Egyptians may have rolled, or the devoted Aztecs have struggled hopelessly against their Spanish conquerors.

The contemplation of the plains produces in him yet another train of thought. He conjures up an historical novel or poem, but finds he has merely repeated the ideas he has read before: he casts them aside and starts afresh; and still he envies the artist the ever-changing phases, and the botanist the unsearchable workings, of Nature. To him there are limits fixed and defined: his speculations are restricted to the period of man's existence on this globe, but for the painter and botanist the range and variety of subject are illimitable.

Thus the pasture and the prairie grow up and die away, containing, like most things in this world, their quota of good and bad. Some weeds go unregarded; the pernicious effects of others become so prominent that they are recognized at once and hated accordingly, like the grass *Cenchrus tribuloides*, which bears a prickly fruit that winds itself into the wool of the sheep, and renders the rearing of sheep where it exists impossible; while other plants, such as clover, and the blue grass, arrest the attention of even the careless agriculturist by their manifest merits.

Now, to all, these herb-clothed portions of the earth offer themselves in various phases according as the mind is prepared to receive them; and happy is he who can so adjust his mind, and concentrate his thoughts upon the phase required; though so devious are the paths of Nature that he will often travel far, and then, as a man traversing a labyrinth, be checked by some such knotty question as: "How does a plant obtain its nitrogen?" and he will have to return to the post from which he started. And such are the difficulties which have deterred those who have written on the formation of pastures from going further on their course. They have rested content with a description of the peculiarities of each plant.

But to him who tries, both as botanist and agriculturist, to fathom the mysteries inseparable from a meadow, whether in the New or the Old World, difficulties present themselves "not in single spies but in battalions." Nature alone supplies enough subjects for the closest study and investigation: depth of soil, worms, showers, dews, periods of drought, periods of wet, grubs, birds,—each and all arrest the mind, and claim due consideration. And when to these are added difficulties of man's own providing, necessary though they be, the solution seems to become a hopeless problem. Now no longer is the battle of plants waged merely with the weather and their other natural antagonists, as they may be fitly called; no longer is the struggle modified into the simple solution of the survival of the fittest; for the farmer produces new enemies to pasture in the shape of stock and the scythe, for cattle select the plants they like best and leave the worst to seed, and the ruthless scythe exposes the delicate stem to the heat of the sun.

An opportune shower has preserved a field from the pernicious effect of soft oat grass (*Bromus mollis*), by thus rendering it palatable to stock, and so preventing its seeding, while the want of rain has caused a meadow, almost contiguous, to be impregnated with this obnoxious weed.

The struggle of plant life is always waging in a pasture, and unless the issue of the battle is directed by animals or men, the most vigorous get the upper hand.

Nature, with her customary and marvellous counterbalancing characteristics, has foreseen this possibility and provided against it, for in a wet season stoloniferous grasses (whose travelling shoots have then the power of sending innumerable roots into the ground, each to become a parent plant) cover the ground to such an extent that the superficial observer is tempted to declare that the meadow which he views is entirely composed of creeping grasses. On the other hand, in a dry season, deep-rooted plants such as tall fescue (*Festuca elatior*) gain the mastery and apparently oust their opponents. The vigorous grasses characterized by an underground growth, such as fox-tail (*Alopecurus pratensis*), and which are amply provided for by Nature in respect of hardihood when growing, are scanty seed-bearers; and even when they do perfect their seeds, so small is the store of food contained in them, compared with their immediate neighbours, that a large percentage of them germinate only to wither away. Rye-grass and the smaller dog's-tail (*Cynosurus cristatus*), deprived of other means of reproducing their species and fostering them, bear seeds that are eminently qualified to reproduce themselves.

Let him, therefore, who essays to unravel the mysteries of our green meadows remember to cultivate to the acutest degree the faculty of ocular observation, for

> "Segnius irritant animos demissa per aurem
> Quam quæ sunt oculis subjecta fidelibus, et quæ
> Ipse sibi tradit spectator."

Let him also learn to employ and utilize the intelligence of others; and above all let him not be surprised if, after much patient study and investigation, his heart sinks within him, appalled before the host of difficulties; as when, for example, the shadow of a passing cloud on a sunny day reveals to him the individuality of the 400 plants in each square foot of pasture, which have before escaped his attention, and the thought flashes across his bewildered mind of the 400 parts played by each plant, and the 400 times 400 causes that effect them. Almost hopelessly he perceives that the knowledge which he is in search of, and which he fancied he had in his hand, has eluded his grasp like a fire-fly, and left only a flash behind; and for a moment his mind is enveloped in darkness, overpowered by the infinity of Nature. The searcher after truth, however, recovers, recognizes his difficulties, recalls the object of his pursuit, returns to it with renewed energy, and, with unbiassed mind, records his observations day by day.

ALPINE HAZE.

THAT no letter has appeared on the common occurrence of this phenomenon in the British Isles is one of a thousand tokens of the small amount of interest in atmospheric phenomena taken by the public in this country. In bright days when the atmosphere at the earth's surface is nearly calm and moderately dry, the sky being nearly devoid of clouds, horizontal layers of buff-coloured haze may be frequently seen near the horizon in almost every locality in the British Isles where the air is free from the smoke of our large towns. I do not happen to have seen it nor have I heard of its occurrence on the west coasts of Scotland or of Norway. I have frequently noticed it when out of sight of land. It would be interesting to know whether it is seen at a distance of 400 or 500 miles from the nearest shore. At St. Aubin's, Jersey, at an elevation at which the French coast near St. Malo is rarely visible, a stria of this haze is often the accompaniment of mirage, the inverted image of the white-tipped rocks appearing to hang from the layer of haze, and the mirage disappearing with a change of the observer's elevation, but the line of haze remaining visible. The mirage was, when first seen, mistaken for a few minutes by some members of my family for a series of water-spouts.

I have long ago given the specific name of *nebula arida*, "dust-haze," to the phenomenon dealt with in this letter; and I still think that the English title "dust-haze" is preferable to "earth-haze," or any equivalent of the former to any of the latter in foreign languages, the latter term being too general, and capable of including the haze or mist produced by the presence of water particles. The word "dust" does not exclude organic matter, although ordinary dust-haze consists in most cases, as I think, of inorganic particles. On the other hand, any name which appears to localize the phenomenon is scarcely admissible. Dust-haze may be somewhat easily distinguished from ordinary mist or water-haze by its colour appearing of a reddish-buff tint in reflected light; and unless in complete shade from direct light, rarely becoming neutral; whereas mist usually appears gray, neutral, or bluish in reflected light, and yellow, orange, or red in transmitted. Patches—or, as they appear at a distance, bands—of dust-haze often become beds of the under surface of *cumuli*, to the formation of which clouds they then seem to bear a causal relation. As frequently in our islands, the haze is replaced during the night by stratiform clouds at its own level. In these cases there can be, I think, little doubt that the solid particles cause the precipitation of vapour. This fact somewhat militates against M. Antoine d'Abbadie's theory that the haze is really dry air, a supposition which for other reasons I regard as untenable.

Seen near the sun at sunset, bands of dust-haze are mistaken by many observers for threads of *cirrus* (what I term *cirro-filum*), and moreover the two phenomena are not uncommonly seen at the same time. As observations at sunset are useful in forecasting weather, the observers should take care to remember that lines of *cirrus* are always more illuminated in transmitted light than any species either of haze or of stratus cloud; secondly, that the *cirrus* threads appear slightly arched when viewed across the line of sight, and radiating when more coincident with it; and lastly, that a slight curl here or there very often betrays the existence of the lofty ice-cloud. I have frequently given rough sketches of these latter sunsets to observers, and these have borne a singular likeness to Antoine d'Abbadie's sketch of the dust-haze itself (NATURE, November 22, p. 79). But I do not understand this sketch, or in what sense it represents two *horizontal* bands.

In conclusion, I may perhaps be permitted to refer to two phenomena slightly related to the subject of this letter. The first is smoke. This is much more "accumulated" or less amorphous than water-dust, although its optical characteristics resemble somewhat closely those of water-dust. On the other hand, it is much more amorphous than dust-haze; and even the line left in the atmosphere by a steamer on the sea horizon on a calm day will scarcely be mistaken for dust-haze. Smoke when at a considerable elevation undoubtedly produces *cumuli* under favourable conditions. A string of ill-defined *cumuli* may be seen in the smoke of a burning forest or heath when carried a long way from land by a wind from the shore. This condensation is probably principally caused by the presence of solid particles, as in the case of dust-haze, but it may be borne in mind that a large quantity of vapour is carried up with smoke.

Lastly, the keen eye will soon learn to distinguish a peculiar haze often noticeable in England, especially over the wheat-producing districts, in fair calm weather in the month of September. This haze is also visible in some, and probably in many, parts of continental Europe. It is caused by flying Aphides, ten or more of which may be often captured in a cubic yard of air at about 10 feet from the earth's surface. In reflected light the haze has a tint of tender ultra-marine ash.

W. CLEMENT LEY.

Lutterworth, December 8.

NOTES.

MR. RALPH COPELAND, Ph. Doc., F.R.A.S. has been appointed Astronomer Royal for Scotland, and Professor of Practical Astronomy in the University of Edinburgh, in the room of Prof. Piazzi Smyth, resigned. Prof. Copeland has proved himself to be among the most skilful of modern observers.

M. DITTE has been elected to succeed the late Prof. Debray at the Sorbonne.

THE Paris Municipal Council will shortly be asked to grant the funds required by Prof. Giard to provide a laboratory and to secure the necessary assistants.

WE refer elsewhere to-day to the dinner given on Tuesday, the 11th inst., at Christ's College, Cambridge, to celebrate the completion of the ninth edition of the "Encyclopædia Britannica." The chair was of course occupied by Dr. Robertson Smith, the editor. Among the scientific contributors present were Sir Frederick Abel, Dr. Affleck, Sir Nathaniel Barnaby, Dr. Buchan, Prof. Cayley, Prof. Darwin, Mr. F. Darwin, Prof. Dittmar, Prof. Michael Foster, Dr. A. Geikie, of the Geological Survey, Dr. Glaisher, Sir F. Goldsmid, Prof. Cleland, Prof. Marshall Ward, Dr. Creighton, Prof. Greenhill, Dr. Günther, Sir Charles Hartley, Baron von Hugel, Prof. Keane,